



# Demand Response

## Overview of Strategic Options

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# Definition of Demand Response

- Demand Response (DR) is:
  - The temporary reduction of electricity demand caused by customers accepting a decreased level of service in response to a financial incentive or other request.

# Major DR Program Types

- Direct load control
- Bidding and voluntary “incentive” programs
- Interruptible rates
- Dynamic rates such as RTP and CPP

# Unifying Theory for DR

- The amount of demand response that can be achieved is a function of:
  - Motivation
  - and
  - Capability

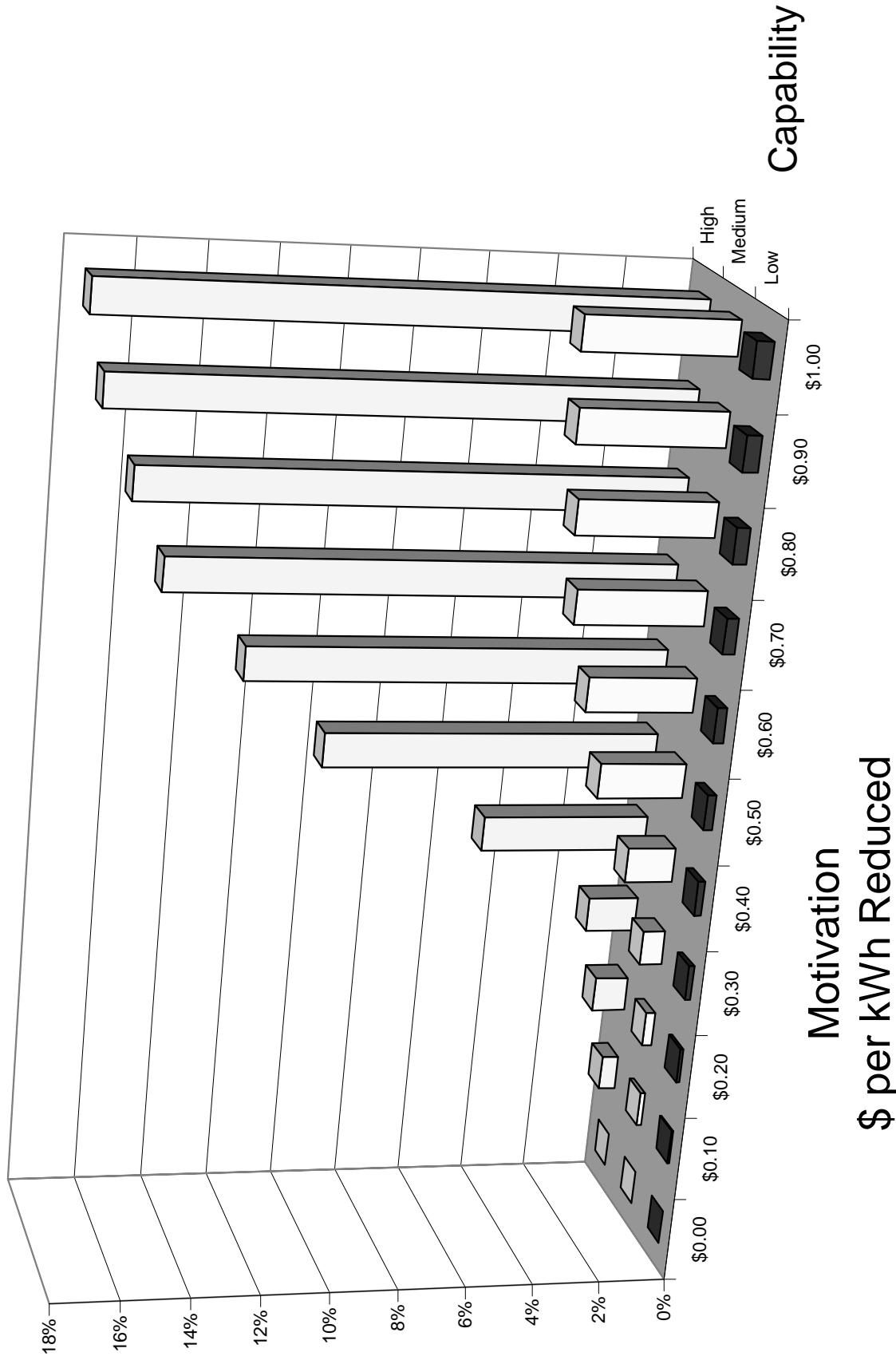
# Motivation

- The combination of several program attributes define motivation
- Key attributes are:
  - Level and structure of incentive
    - Can be direct financial, direct outage avoidance, or indirect outage avoidance (civic duty)
  - Timing and length of reduction period
  - Penalties for not reducing
  - Advance notification
  - Level of control – ability to override
    - Expected number of (maximum) events
    - Measurement and incentive uncertainty
    - Transaction hassle

# Capability

- Defined as the ability and ease to reduce the level of service and thus demand
- Capability takes several forms
  - Direct load control network
  - Customer awareness, experience, knowledge (strategy)
    - Centralized control technology
    - Variable control technology
    - Energy information technology
      - Notification network
- Customers with higher capability will require less motivation to reduce load

# DR Capability is Critical



# DR and Smart Meters

- Smart Meters are one source of DR capability
  - However, Smart Meters by themselves would still fall in the low capability range
- Interval-capable meters are a required part of most DR options
  - Needed to calculate or verify load reduction
  - Direct load control is the exception
- A Smart Meter communication network can be leveraged to support many DR concepts
  - Supports notification, overrides, and DLC
  - The value of real-time or near real-time customer access to load profile data is limited



# DR and Enhanced Automation

- Enhanced Automation (EA) is DR capability that resides within the customers' facilities
- EA includes:
  - Knowledge of available DR programs
  - DR action plans
  - Enhanced control technology
    - Central point control
    - Variable service control
  - Energy information technology
  - Baseline calculation and reporting support capability

# EA Investment Issues

- The motivation from a DR program is rarely sufficient to cause customer investment in capability building
- Promoting enhanced technology requires assessment of benefits beyond DR
  - Everyday energy savings
  - Comfort improvements
  - Lower O&M or production costs
- Integrated DSM is the current buzz and may be the only effective way to promote customer investment in capability

# Direct Load Control Features

- High initial investment for capability installed by service provider
  - Capability = network, switches, smart thermostat, marketing
  - No customer-installed capability typically required
- Best target: residential and small business
- Common end-uses:
  - Package a/c, water heaters, pool pumps, and irrigation pumps
- Often structured as an “emergency” program
  - Most programs offer guaranteed capacity payments
  - Some offer additional incentives when called
  - Moderate customer preference for override capability
- Smart (interval) meters not required



# Direct Load Control Features

- Interesting Innovations
  - Expansion of communication options
    - Enabling two-way communication
    - Leveraging existing assets
  - Under-frequency control
  - “Smart” cycling algorithms
  - Smart thermostats
  - Integration with dynamic rates
  - Third Party Service Providers

# DR Incentives Features

- Pays incentives to customers based on the amount of load reduction that occurs
  - Incentive structures range from fixed \$ per kWh reduced to complex bidding schemes
- Requires relatively low up-front investment by service provider
  - Incentive payments often tied to specific events
  - Up-front payments for promised reduction is less common
    - Penalties typically apply if promised reduction not achieved
- Best target: large industrial
  - Process rescheduling is most common strategy
  - HVAC and lighting strategies starting to gain ground
- Customer-installed capability (EA) is critical
  - Offering incentives to install EA is becoming more prevalent



# DR Incentives Features

- Interval meters are required
  - Real-time access to load data seen as a useful tool by many participants
- Major customer concern is payment uncertainty
  - Only option that requires a baseline calculation process
- Generally viewed as an “economic” program
  - A preferred option for ISO/RTO programs
  - DR incentive programs with up-front payments and penalties act more like an “emergency” interruptible rate program
- Many participants prefer program designs that are more voluntary in nature
- Not clear if complex bidding processes provide added value compared to higher transaction costs



# Interruptible Rate Features

- Provides rate discounts to large customers that are willing to reduce their load to a specified level during a system emergency
- Generally involves high penalties if “firm” load levels are not achieved
- Usually structured as a emergency program
  - Often sold to customers as a last-resort option that will be called very rarely
- Best target: large customers (greater than 500 kW)
  - Most either rescheduled processes or utilize back-up generation
- Interval meters are required
  - Real-time load information viewed as important by most participants



# Dynamic Rates Features

- Customers pay varying rates that more closely reflect the cost of electricity production
- Two most common forms are real-time and critical peak pricing
  - Real-time prices can vary every hour and often are tied to the wholesale price
    - Viewed by some in the industry as being more complex than what is needed to encourage demand response
  - Critical peak pricing is similar to a time-of-use rate except there is uncertainty associated with the timing and/or price of the high price rate period
- Interval meters are required
  - Most participants do NOT view real-time load information as important

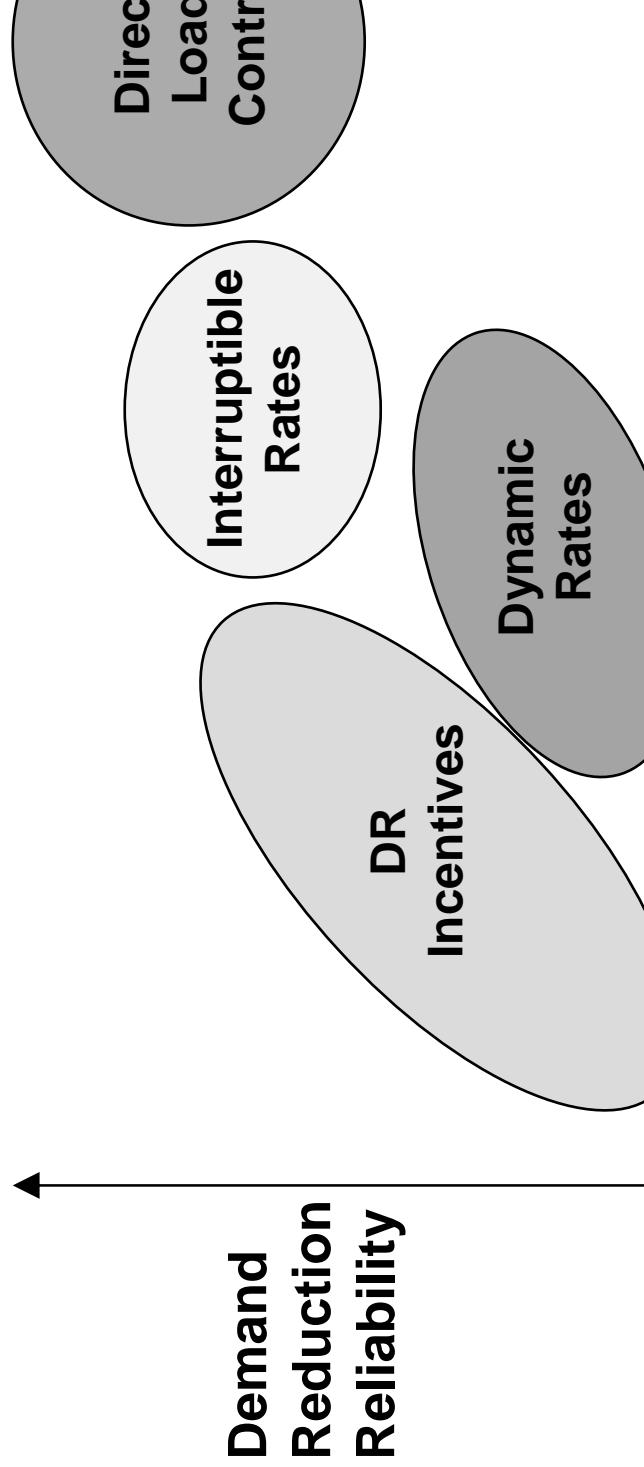


# Dynamic Rates Features

- Best target: Mid-to-large commercial and industrial
  - Somewhat applicable to all customer segments
- Generally viewed as an “economic” program
  - A preferred option for full-service utilities
  - Seen as a wasted resource if not called the maximum number of times allowed under the program rules
- Customers tend to view this option as a price increase rather than a revenue-neutral pricing option
  - As with DR, encouraging customer-installed capability (EA) is critical
- Measurement certainty is the biggest advantage over the DR Incentive Program



# Contrasting the DR Options



Up-front Cost Commitment For Supplier



Questions?

Thank you

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